Another great step in advance has recently been made. We have received from Messrs. Leitz, a German firm which produces perhaps more microscopes than any other, two models designed with a view to incorporate the most important features of the English and Continental models.

In one the tripod base is well spread, is exceptionally rigid in the horizontal as well as the vertical position, and allows of free access to the substage. The substage is of the compound type, consisting of rack and pinion focussing adjustment, with centering screws controlling condenser sleeve, which is of the Royal Microscopical Society standard gauge. The stage is of the square fixed type, and may be provided with a detachable mechanical stage. The curved limb allows of additional working space on the stage and incidentally forms a convenient handle for lifting the microscope. The fine adjustment consists of the cam and worm screw continuous motion, originally introduced in the Leitz Continental microscopes, coarse adjustment being by diagonal rack and pinion, and draw-tube with millimeter scale.

The other form is similar, but it is fitted with a mechanical stage forming an integral part of the instrument. The stage is provided with anterior, posterior, and lateral movements of greater range than is generally found in similar models, and is controlled by two milled heads mounted upon one spindle. The stage is also provided with millimeter scales and verniers reading to 1/10 mm. (1/250 inch).

A model on the above lines, but of much larger dimensions and having a wide body-tube, is particularly valuable in photomicrography. It is stated that these new models are made in the firm's London workshop.

But Messrs. Leitz, we now find, are not the only firm which is endeavouring to make stands as complete as possible in the way of adjustment. We have received from Messrs. Angus, the London agents of the Spencer Company of the United States, one of their latest models, which is admirably designed and worked out, and in it we find the English arrangement for the centering of the substage, as well as the German device for oblique illumination.

In these new models furnished by Leitz and Spencer, then, we find the maximum of adjusting power, and on this account they may be considered to be universal instruments, and it should not be forgotten that this universal quality of adjustment need not necessarily be confined to instruments of the largest size. The mechanical stage and the oblique illumination device may be made much lighter than they generally are, and the Spencer model shows how space may be saved by mounting the two screws of the former on a vertical spindle.

One of the great outstanding differences, then, remaining at present between the English and Continental microscopes is the absence of the simple oblique illumination device in the former. Regarding the use of this we are aware there are many different opinions.

NOTES.

IT is officially announced that the King has become patron of the Entomological Society of London.

AT the meeting of the Chemical Society, held on Thursday, June 5, Prof. Dmitri Petrovitsch Konovaloff, of St. Petersburg, and Prof. Alfred Werner, of Zurich, were elected honorary and foreign members of the Chemical Society.

THE annual conversazione of the Royal Society of Arts will be held on Tuesday next, June 17, at the Natural History Museum, South Kensington, and that of the Institution of Electrical Engineers will be held at the same place on Thursday, June 26.

THE trustees of the British Museum have agreed to undertake the publication of the natural history results of Capt. Scott's Antarctic expedition. The work of publication will be carried out at the Natural History Museum, South Kensington. It is understood that on the arrival of the *Terra Nova* in this country the collections will be sent in the first place to the Natural History Museum.

THE Cannizzaro prize of 10,000 lire, founded by the late Dr. Ludwig Mond, has been awarded by the Reale Accademia dei Lincei, of Rome, to Mr. Frederick Soddy, F.R.S., lecturer in physical chemistry at the University of Glasgow, for his researches in radio-activity. The presentation of the prize took place in the Capitol on June 1, in the presence of his Majesty the King of Italy.

THE annual general meeting of the Research Defence Society will be held on Tuesday, June 24, at five o'clock, at the Royal College of Physicians, Pall Mall. The chair will be taken by Sir David Gill, K.C.B., F.R.S., president of the society. The report will be presented by the Hon. Sydney Holland, chairman of committee. Other speakers will be Sir William Osler, regius professor of medicine at Oxford; Bishop Frodsham, sometime Bishop of North Queensland; and Mr. Waldorf Astor, M.P.

THE death is announced of Dr. Forbes Winslow in his seventieth year. Dr. Winslow was known as a specialist in lunacy, and founded the British Hospital for Mental Disorders. He was the author of numerous works on mental diseases and kindred subjects, among them being "The History of Lunacy Legislation," "Manual of Lunacy," "The Suggestive Power of Hypnotism," and "The Criminal Responsibility of the Insane." For eight years he was editor of *The Psychological Journal*.

THE death is announced, in his sixty-third year, of Mr. W. McMurtrie, the predecessor of Dr. Wiley in the post of chief chemist to the U.S. Department of Agriculture. Mr. McMurtrie had served for some years as assistant chemist before his appointment to that office in 1873. In 1882 he left Washington and became professor of chemistry at the University of Illinois. While holding the latter post he was also chemist to the Illinois State Board of Agriculture. Of late years he had been a consulting chemist in New York. He was the author of monographs on the culture of the beet, the culture of sumac, grape culture in the United States, and wools and other animal fibres.

IN a note in the issue of NATURE for May 22 last (vol. xci., p. 300) attention was directed to the formation of an influential committee to endeavour to establish a uniform notation in the theories of potential and elasticity. The committee of organisation has issued an appeal to astronomers, mathematicians, and physicists, asking them to cooperate in this attempt to secure uniformity, and as a beginning solicits answers to the question: "What are the notions and notations in respect of which it is desirable to establish uniformity?" Answers to this inquiry—which may be in English, French, German, or Italian—should be addressed Mr. Arthur Korn, Charlottenburg, Schlüterstrasse 25. As has been stated, discussions on the subject will be arranged to be held at the international congresses of mathematicians in 1916 and 1920, and it is hoped that the final report of the committee will be issued in 1921.

DR. F. W. MOTT, F.R.S., delivered the first of his Chadwick Public Lectures on Friday, June 6, upon the subject of "The Structure and Development of the Brain." In the course of the lecture he described the structure of the brain in relation to its function as the organ of mind, particular attention being directed to the significance of the folds and fissures, first as determining the extent of the surface grey matter, and, secondly, in the formation of a convolutional pattern. Just as faces show similar features and expression by heredity, so the convolutional pattern of the brains of relatives exhibits a similarity in its folds and fissures. The fact that a parallelism exists between arrest of development of the grey matter and feebleness of mind, and between loss of mind and the decay or destruction of the grey matter, tends to prove that the intellecual and moral character of the individual should be regarded as a natural process of organic development—a product of nature and nurture. The subject of Dr. Mott's second lecture to-morrow, June 13, at 5 p.m., at the Royal Society of Arts, is "Inborn Potentialities of the Brain of the Child."

A JOINT session of the Aristotelian Society, the British Psychological Society, and the Mind Association was held on June 7 and 8 at University College, London, and Crosby Hall, Chelsea. The first meeting consisted of a symposium, "Are Intensity Differences of Sensation Quantitative?" by Dr. C. S. Myers, Prof. Dawes Hicks, Dr. H. J. Watt, and Dr. Wm. Brown, under the chairmanship of Prof. Spearman. Dr. Myers showed that the "all or none" principle is obeyed by all kinds of reflexes and all kinds of sensibility. The type of reaction is therefore the correlate of quality of sensation and the difference of degree—moreness or lessness of the same reaction is the correlate of difference of intensity of sensation. The second and third meetings, presided over by the Hon. B. Russell, were devoted respectively to a discussion on memory and consciousness, opened by Dr. Robinson, and to a symposium, "Can There be Anything Obscure or Implicit in a Mental State?" by Mr. H. Barker, Prof. G. F. Stout, and Prof. R. F. A. Hoernle. Dr. Robinson said that M. Bergson, in his "Matter and Memory," neglected the fact that memory was an assertion, and that he did not do justice to the function of meaning in remembering. Intuition and intelligence must be somehow inclusively related. A vigorous discussion revealed many criticisms opposing this anti-Bergsonian thesis. In the symposium Prof. Stout maintained that within the field of consciousness, whether of mere sense experience or of thought, there are contents which are not separately discerned. The opposing point of view to this was due to a confusion resulting from the fact that the presence of implicit consciousness can only be ascertained by a process of analytic scrutiny rarely present in normal conscious life.

MR. ANANDA COOMARASWAMY has issued part iv. of his useful album of Indian sculpture, "Visvakarma." The plates include two representations of the Buddhist Avalokitesvara, the personification of power, preserver of the world and men, from Ceylon; one of the local goddess, Pidári, from Madras, and a set of Nága and Nágini water or snake deities from Ceylon, Ajanta, and southern India. In some cases the reproduction of the photographs is not as clear as might be desired, but they are sufficient to answer the purpose of the publication. The collection will be of much value to students of Indian religion, archæology, and art.

THE recent report of the census of the people of the Andaman Islands, taken in 1911, shows a melancholy decrease in the population. Of the Yerawa and Bojigngiji groups, estimated to number 3500 when British occupation began in 1858, only 455 survive. This decrease is attributed by Mr. R. F. Lowis to three causes—increased infant mortality in the case of parents who have come under the influence of civilisation, and to an epidemic of measles; a tendency to infertility as a result of the introduction of syphilis; an increased death-rate among adults, accounted for by the draughty buildings in which the sick are housed, and the use of clothes and blankets in hospitals, which are discarded when the patients resume their jungle life. The savage Jarawas alone, who live isolated from civilisation, seem to be holding their ground, and it is only in this group that any hope remains of the preservation of this remarkable people.

THE alleged atrocities in connection with the rubber trade in the Putumayo district of Peru, now the subject of investigation, have directed attention to the Indian tribes of that region. An English explorer, Capt. T. W. Whiffen, whose evidence has been given before the Parliamentary Committee, contributes to vol. xxiv., part i., of *Folk-lore* an interesting account of these races. He was probably the first and the last white man to observe them while they were unaffected by outside influences. These tribes of the Issa-Japara River region do not, as Dr. Martius supposed, furnish an example of culture degeneration. There is no trace of any submerged superior culture; on the countrary, they have not emerged from the condition of the Stone age. While the people to the north smoke cigars and those to the south use pipes, they make a treacly decoction from the leaf which friends lick ceremonially in the tribal palaver, or to ratify a contract. When twins are born, the second, particularly if a girl, is killed; and deformed or sickly children are drowned by the mother. Among the Boro the father practises the couvade. The only social or artistic function is the dance, announced by beat of drum heard at a distance of eight or ten miles. Prisoners are slain and ceremonially eaten by their captors. After death the soul hovers round the hut for a time, and then wanders to the happy hunting-grounds of the Good Spirit. It may be hoped that Capt. Whiffen will publish a detailed account of these people, with a reproduction of the good photographs which he exhibited before the Folk-lore Society.

THOSE who were present at the fourth International Congress of Genetics at Paris in 1911 will always recall it as a meeting that was very much alive, and evidence of this is to be found in the report which has recently appeared. Some fifty-eight communications made to the congress are printed in this volume of nearly 600 pages. The greater part of them deal with plants, though there are a dozen papers on animals, and several of a general nature. Many of the communcations are of great interest and permanent value, and special mention may be made of Orton on the inheritance of disease resistance in plants, of Lotsy on crosses between different species of Antirrhinum, and of Walther on the inheritance of coat colour in horses. But the whole volume is full of interest and suggestion, and valuable as giving an excellent idea of the scope of genetic research, and of the great activity at present prevailing. Two languages are used throughout—French and English. A French abstract is given with the English papers, while all other papers are in French with an English abstract appended. The volume is beautifully got up and fully illustrated, a pleasant feature being the collection of portraits of workers in this branch of knowledge. It is published by Masson et Cie., and costs 25 francs.

IN an address given at the anniversary meeting of the Royal Society of South Africa in March last, the president of the society, Dr. L. Peringuey, dealt with the antiquity of man in South Africa. So far no human remains have been found in South Africa which belong to the Palæolithic period. On the other hand, stone implements of the various European Palæolithic periods of culture abound in South Africa—Chellean, Acheulean, and Mousterian—but there is no evidence that these types followed each other in point of time; all seem to have been in use at the same period. Dr. Peringuey is convinced that there was a direct relationship between the later Palæolithic cultures of Europe and South Africa—the Aurignacian and Solutrean. The problem of determining the degrees of antiquity of the various Palæolithic cultures of South Africa is rendered difficult by the fact that the climate and the fauna of South Africa have altered very little, if at all, during the Pleistocene period, whereas in Europe there have been recurring periods of change. Lately the fossil remains of two extinct antelopes—"gnu- and pallah-like creatures"—have been discovered in the Free State, with large flakes and other implements of a Palæolithic type. Remains of very similar antelopes occur in the Pliocene formations of India and Attica. Molar teeth of a mastodon have also been found in gravels of the Vaal River along with Palæolithic implements. It will be thus apparent that man's presence in South Africa is of great antiquity, although as yet the necessary data have not been gathered for estimating the degree of that antiquity. So far only Europe and certain parts of America have been searched for man's earliest traces; it seems very probable that Dr. Peringuey and his colleagues may soon be in a position to elucidate, by their discoveries in South Africa, some of the problems which are at present puzzling their European colleagues.

MR. R. S. PEARSON, of the Indian Forest Service, has published (Indian Forest Records, vol. iv., part v.) a detailed and valuable report on the utilisation of bamboo for the manufacture of paper pulp. Four species of bamboos (*Bambusa arundinacea, B. polymorpha, Cephalostachyum pergracile, Melocanna bambusoides*) were examined with regard to their suitability for paper-making; the area over which the examination took place was restricted to Lower Burma and the west coast of the Indian peninsula, as both these localities are geographically well suited for import and export purposes, and contain vast areas covered with bamboos. Figures as to yield, &c., were carefully collected; in order to obtain practical proof of the quality and cost of preparing pulp from bamboos about eighty tons of raw material of the four species were converted into pulp, and eventually into paper at Calcutta; and the report is printed on paper made from *B. polymorpha* (the most useful species), both nodes and internodes being used. The report contains very valuable data for estimating the probability of the success of establishing a paper-pulp industry in Burma and India.

THE interesting weather maps for May 9–15, published in the first issue of the Meteorological Office charts of the North Atlantic and Mediterranean for June, show a continuation of the type of conditions which had prevailed during the preceding two weeks, affording a noteworthy illustration of an almost stationary cyclonic system over the north-eastern quarter of the Atlantic for nearly three weeks. The high pressure in the north of Europe and western Siberia spread along the arctic circle to Iceland, formed a barrier against the eastward progression of Atlantic disturbances, and held the depression above referred to in practically the same position until nearly the middle of May. The latest reports showed that "a huge area of high barometrical pressure covered nearly the whole of the North Atlantic." Some icebergs were passed in 42° 30′ N. and 49° W. about April 4. Since April 10 (up to the time of going to press, on May 15) ice had not been sighted south of latitude 44° N.

"FORECASTING the weather" is the title of an interesting bulletin (No. 42) by Mr. G. S. Bliss (section director), recently issued by the U.S. Weather Bureau. It shows the great advantage enjoyed by the bureau in being able to watch the developments and movements of storm-areas over the entire country between the Atlantic and the Pacific, and from Canada to Mexico and the West Indies, by the receipt of telegrams twice daily containing observations made at the same physical instant of time. The author shows how perfectly the machinery works, and how rapidly the operations are performed, from observation to map-making. In less than two hours the various forecasters are prepared to issue particulars for a day or two in advance for any State or city with nearly as high a degree of accuracy as they can for their own locality. This useful bulletin is accompanied by weather maps and an epitome of the various processes at work in the atmosphere, to assist students in applying to the maps the principles learned in a cursory study of the elements. It is claimed that by mapping the whole northern hemisphere the Weather Bureau is enabled to forecast general conditions for a week or ten days in advance with a creditable degree of accuracy.

IT is well known that the distance of the epicentre of a great earthquake is determined by the duration of the first series of preliminary tremors. The relation is not a simple one for all distances, but Mr. G. Negri states (*Anales de la Soc. Cien. Argentina*, vol. lxxv., 1913) that the duration I_1 of the preliminary tremors in minutes and the distance S of the epicentre measured along a great circle in thousands of kilometres are connected by the following relations: if S be equal to or less than 1, $I_1 = 2{\cdot}05.S$, if S lie between 1 and 9, $I_1 = \sqrt{}(16834.S) - 2{\cdot}32$, and if S be greater than 9, $I_1 = (S + 5{\cdot}929)/1{\cdot}463$. Thus the curve which represents these relations consists of three portions which are respectively straight, parabolic, and straight. Mr. Negri suggests that earthquakes which originate at distances represented by the above limits might be termed near, distant, and antipodal.

IN the May number of *The American Journal of Science*, Prof. L. P. Wheeler, of Yale, examines the more recent measurements of the refraction and dispersion of metals in the light of the electron theory of dispersion. The experimental data cover silver, copper, gold, nickel, and cobalt, but the accuracy attained is still insufficient to make the comparison satisfactory. It appears, however, from the results available that the number of free electrons in each of these metals must increase with the frequency of the incident radiation slowly and fairly uniformly in the infra red, and more rapidly in the regions for which the metals are transparent. The dispersion due to the free electrons is more important than that due to the bound electrons, especially in the region of short wave-lengths, and the form of the dispersion curve given by theory agrees with that found experimentally in its main features, although the inaccuracies of the experimental results do not permit of any satisfactory comparison of details.

Science Progress for April contains an important article by Dr. J. V. Eyre on the projected revival of the flax industry in England. Dr. Eyre has, on behalf of the Development Commissioners, visited, during the past two years, the principal flax-growing countries of Europe, and made a special study of the methods adopted in cultivating the plant and separating the fibre. The information gathered has been recently presented to the Commissioners in the form of a report, which is summarised in the article now referred to. The inquiry leaves no room for doubt that the climate of this country is well suited to flax, and experiments are in progress as to the possibility of cultivating and separating the fibre at a profit. Taking into account the fact that flax is now worth nearly twice as much as it was ten years ago, and other considerations which are specified in detail, there is strong reason to believe that the judicious revival of the industry by improved methods would be of benefit to British agriculture. During the past year flax was grown in Bedfordshire experimentally as a fibre crop, and useful information gained as to the more difficult operations of harvesting and retting, special tanks being constructed for the latter purpose. It is proposed in the present year to make trials on a larger scale, and for this purpose a society has been formed under conditions of non-profit trading, so as to be eligible for a grant from the Development Commission.

THE third of a series of articles on the Panama Canal appears in *Engineering* for June 6, and deals with the lock-gates. The locks are 110 ft. wide, and have a nominal length of 1000 ft.; intermediate gates are provided, together with valves, allowing lengths of chamber of 278·5, 370, 550, 908·5 and 1000 ft. respectively to be employed, an arrangement which will result in a considerable saving of time and water with vessels of short length. The gate leaves are built of flat girder work sheathed with plating, and the whole of the support is given by a pintle at the base and a yoke above; there is no roller path provided. The leaves have a length of nearly 65 ft. and are 7 ft. wide; the largest are 82 ft. high. The largest leaf has a weight of 1,483,700 lb. The material used in the gates is open-hearth steel, having an ultimate tensile strength of 60,000 lb. per sq. in. Under ordinary conditions, the working stresses do not exceed 13,000 lb. per sq. in., and do not exceed 15,000 lb. per sq. in. under extreme conditions.

THE city of Edinburgh recently appointed a commission "to visit various cities in England with a view of inspecting self-propelled cars and obtaining further information on the subject." The deputation has issued a report which is commented upon in *Engineering* for June 6, and gives some valuable data as to various installations for running tramcars by petrol, in place of by cable or by electricity. At Morecambe the autocar service was opened eighteen months ago: the line is 1·2 miles long, and passes through a sparsely populated district. The first year's working shows a surplus of receipts over all expenditure. The car seats thirty-seven passengers; its weight unloaded is 8 tons. It is propelled by a 40 h.p. fourcylinder petrol engine, the mileage per gallon of petrol being seven to eight. The average daily run for each car is about seventy miles. The total cost of car is from 985*l*. to 1150*l*. The Leyland Motor Company, which built the cars, gave a five years' guarantee that the costs of working, exclusive of wages, upkeep of car body, and administration expenses, should not exceed 3¼*d*. per car-mile so long as the price of petrol did not exceed 9*d*. per gallon. Birmingham, Coventry, and London were also visited, and as the result of the inquiries, the deputation recommends the introduction experimentally of petrol-driven cars in Edinburgh.

AMONG the latest additions to the "Cambridge Manuals of Science and Literature" are five volumes dealing with scientific subjects. Prof. John Cox, under the title "Beyond the Atom," tells the story of discoveries in radio-activity, and his brief summary of the work of Rutherford, Curie, and many others will prove of interest to students and general readers alike. Dr. Gadow's book on "The Wanderings of Animals" gives the main facts of geographical distribution in a readable form. Prof. Fortescue writes on wireless telegraphy for readers with a general scientific knowledge who desire to know something, not only of the accomplishments of wireless, but also of the means by which they are attained. Mr. O. H. Latter's book on "Bees and Wasps" deals with British species of Hymenoptera in a thoroughly practical manner, and Mr. Clement Reid's "Submerged Forests" gives a simply worded account of a very interesting series of geological researches. The "manuals" are one shilling net each, and at the rate the library grows the student will be able soon to secure at this small cost an authoritative account of every branch of modern scientific research.

OWING to the development of their optical business, Messrs. Newton and Co., 72 Wigmore Street, London, W., are unable to find space for their philosophical and physical apparatus department, and are consequently disposing of their stock at low prices. The catalogue of apparatus for sale is comprehensive, and includes particulars of shop-soiled and second-hand instruments used in the study of physics and chemistry, lanterns and lantern apparatus, and microscopes and accessories.

OUR ASTRONOMICAL COLUMN.

THE VARIATION OF SOLAR RADIATION.—With the permission of the secretary of the Smithsonian Institution, a definite and important statement under the names of Messrs. C. G. Abbot, F. E. Fowle, and L. B. Aldrich is published in the *Astronomische Nachrichten,* No. 4656, with the title "The Variation of the Sun." The observations from which the conclusions are drawn were begun in the year 1902, when preliminary experiments were made at Washington to determine the solar constant of radiation. About 700 determinations of it have now been secured, and they depend on observations made at altitudes ranging from sea-level to 4420 metres. The results, some of which are mentioned in this communication, will be published in detail in the Annals of the Astrophysical Observatory of the Smithsonian Institution (vol. iii.) now in the press, and will probably appear next month. The authors nevertheless publish in this statement some of the more important conclusions, which are as follows:—

(1) The mean value of the solar constant of radiation for the epoch 1905–12 is 1·929 cal. per sq. cm. per min. (2) An increase of 0·07 cal. per sq. cm. per min. in the "solar-constant" accompanies an increase of 100 sun-spot numbers (Wolfer). (3) An irregular variation frequently ranging from more than 0·07 cal. per sq. cm. per min. within an interval of ten days is established by numerous nearly simultaneous measurements at Mount Wilson, California, and Bassour, Algeria. (4) Indications of two wholly independent kinds incline the authors to think that these variations of solar radiation are caused within the sun, and not by interposing meteoric or other matter.

The extreme importance of the conclusions here stated cannot be overrated, and students of solar physics in its broadest sense will await with eagerness the publication of the detailed investigation.

PROMINENCES ASSOCIATED WITH SUN-SPOTS.—The discovery of radial motion in sun-spots by Mr. Evershed revealed the fact that there are two opposite movements in the penumbra of every spot, the gases at the level of the reversing layer flowing outwards away from the umbra, while those at the higher levels of hydrogen and calcium flow inwards. It was thought that a study of the higher solar region, namely that of the prominences, might shed some light on these remarkable motions, and with this object Mrs. Evershed undertook a study of the fine prominence photographs taken at the Kodaikanal Observatory. The results of this investigation are described in the current number of the Monthly Notices of the R.A.S. (vol. lxxiii., No. 6), and they are accompanied by a series of fine reproductions of numerous types of prominences explained in the paper.

Mrs. Evershed states that the investigation suggests more problems than it solves, yet some preliminary conclusions are nevertheless drawn. The most general result seems to indicate that the movements observed in the prominences situated directly above sun-spot groups are of quite a different kind from those in the penumbræ of spots, being intermittent and variable in direction and amount instead of uniform and constant. Reference is also made to the presence of forces other than those of an eruptive and gravitational nature, which is responsible for such a peculiarity as was observed in some rising prominences which moved with an accelerating velocity into space by a force opposed to gravity.

STUDIES IN STELLAR STATISTICS.—The general question of the distribution and motion of stars in space is perhaps the most important problem of the day, and the attention of astronomers has been turned more and more towards it since the initial investigation of Kapteyn in 1904, who determined for the first time the elements of the two star-streams. Space will only allow here of a list of a few of the more recent papers connected with this subject. Mr. F. W. Dyson has contributed to the two last numbers of the Monthly Notices of the R.A.S. (vol lxxiii., Nos. 5 and 6) two important researches on the distribution in space of the stars in Carrington's circumpolar catalogue, discussing in the first the proper motions in a direction perpendicular to the solar motion, and in the second the proper motions in the direction of the solar motion. In the same publication (No. 6) Mr. H. C. Plummer continues his series of papers on